

U.S. Serial No. 09/611,521 (Attorney Dkt: LIDO:003)
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donating a nonbonded pair of electrons, wherein said synthesis comprises the steps of:

adding maleic anhydride or malic acid to M(OH) + polyfunctional amine + water, and allowing same to react to form the N, N-disuccinamicamino(:functional group).

REMARKS

The Examiner has objected to Applicant's Specification under 37 C.F.R. 1.71 for allegedly failing to provide an adequate written description of the invention. More precisely, the Examiner has stated that the Specification on page 9 has "formulae (i), (ii), and (iii)" that he does not understand because "there are no bonds between R and C_n and any atoms from the compounds and no explanation has been provided."

Applicant respectfully reminds the Examiner that the application should be written for one skilled in the art and should be read and interpreted as for one skilled in the art. *Loctite Corp. V. Ultraseal Ltd.*, 781 F.2d 861, 228 U.S.P.Q. 90 (Fed. Cir. 1985); *In re Skrivan*, 427 F.2d 801, 166 U.S.P.Q. 85, 88 (C.C.P.A. 1970). One skilled in the art would readily understand the formulas about which the Examiner complains. Everyone skilled in the art knows that chemical formulas can be difficult to write with an ordinary typewriter or with a computer having only general or basic word processing software and not graphics software for chemical formulas. One skilled in the art would certainly recognize that the "R" directly above "C_n" would be connected to the "C_n" and that the "C_n" directly above "N" would be directly connected to the "N." Applicant respectfully submits that he is not aware of any key on the keyboard that would provide the vertical line connection that the Examiner claims is needed.

Further, the Examiner's position is particularly curious given the push by the United States Patent and Trademark Office for communications via e-mail. This application was prepared on a computer and forwarded to counsel via e-mail for filing. Such transmittal could not have been effected with the standard software that Applicant and his counsel had if Applicant had had to include the lines the Examiner is stating are needed. This application was ultimately filed in paper form, but the lines the Examiner desires have to be inserted with pen to be vertical.

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Moreover, Applicant does not understand to what the Examiner would think the "R" and the "C_n" and the "N" would be connected in the formula if not to the adjacent elements as standard in the art and as intended by Applicant. Elements adjacent one another in expression of a formula have long been understood in the chemical arts as connected to one another.

Nevertheless, Applicant has provided an amendment to the specification and claims to add the lines that the Examiner deems are needed for clarification.

The Examiner has also stated that on page 10 at lines 29 et seq., the definitions of X, n and R are "not positive in the use of 'may be.'" Applicant has provided an amendment to the specification to change the words "may be" to "is."

The Examiner has also stated that on page 15 at lines 10, 12 and elsewhere in the specification, "Me can not be defined as an alkali metal since Me(OH) is methanol and the methyl group is not belonged [sic] to the alkali metal group." Applicant respectfully requests that the Examiner reconsider his position as Applicant respectfully submits that the Examiner is wrong. MeOH is typically defined as a metal hydroxide in patent literature. The use of Me to represent Group I and Group II metal salts is customary. Contrary to the Examiner's statement, Me is not customarily used to represent a methyl group or methanol when combined with OH. Applicant respectfully requests the Examiner to review the following examples of United States patents which have used "Me" in the manner as Applicant: 4,701,221 to Brunn et al., at col. 3, line 33; 4,566,975 to Allgulin at col. 1, lines 14-24; 5,248,818 to Werle et al., at col. 1, lines 51-55; 4,039,649 to Alagy et al., at col. 9, line - col. 10, line 70; and 5,558,706 to Simko at col. 2, lines 39-43. The very patent cited by the Examiner in rejecting Applicant's claims, Canadian patent no. 2,285,308, uses "Me" to represent sodium hydroxide on page 2 and throughout the description and claims. Moreover, Applicant respectfully submits that even if the Examiner were correct, which Applicant respectfully submits he is not, Applicant is entitled under patent law to be his "own lexicographer" and thus can use essentially any term he desires to mean essentially anything he desires so long as the term is defined in the specification. *Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 228 U.S.P.Q. 90 (Fed. Cir. 1985); *Rohm & Haas Co. v. Dawson Chemical Co., Inc.*, 557 F.

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Supp. 739, 217 U.S.P.Q. 515, 573 (Tex. 1983). Applicant respectfully submits that the meaning of Me in the specification is clear.

The Examiner has rejected claims 1, 7, 11, 15, 19, 23, and 27 under 35 U.S.C. 112, first paragraph for the same reasons he objected to the specification. Applicant respectfully refers the Examiner to his response to those earlier objections for response to these rejections.

That is, Applicant believes one skilled in the art would understand that the "R" directly above " C_n " means the "R" is connected to the " C_n " and that the " C_n " directly above "N" means that the " C_n " is connected to the "N." Nevertheless, Applicants have provided amendment to the claims 1, 7, 11, 15, and 19 to add the lines that the Examiner deems are needed. Claims 23 and 27 did not have the formulas that the Examiner indicated needed additional lines for clarification and thus were not amended.

Also, Applicant has provided an amendment to the claims 1, 7, 11, 15, and 19 to change the words "may be" to "is." Claims 23 and 27 did not have the "may be" language and thus were not amended.

Further, Applicant traverses the Examiner's rejections related to Applicant's use of "Me" and Applicant requests the Examiner reconsider his position in light of the number of patents that Applicant has cited to the Examiner which use "Me" in the manner that Applicant uses "Me" -- to represent Group I and Group II metal salts -- and not to stand for "methyl" or for "methanol" when written with "OH" as stated by the Examiner.

The Examiner has rejected claims 31 and 33 under 35 U.S.C. 112, second paragraph, as being indefinite and under 35 U.S.C. 103(a) as being unpatentable over CA 2,285,308. Applicant has deleted these claims.

The Examiner has also rejected claims 1, 6-11, 15, 19, 23, and 27 under 35 U.S.C. 103(a) as being unpatentable over CA 2,285,308. Specifically, the Examiner has stated that this Canadian reference discloses that "iminodisuccinic acid alkaline salts can be prepared by reacting maleic acid anhydride, alkaline metal hydroxide, NH_3 and water with a specific ratio under cited conditions." The Examiner states further that the Canadian reference differs from Applicant's claims in that the Canadian reference "does not disclose the claimed formulae nor the steps of the process in the method for making a

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modified iminodisuccinimic acid." However, the Examiner adds that the Canadian reference "does disclose similar reactants under steps of the process to form the same or similar products."

Applicant traverses rejections based on CA 2,285,308. That Canadian reference discloses methods for producing the D-L isomers of iminodisuccinate, NOT the same or similar products as Applicant's. Moreover, several deficiencies are apparent in the CA 2,285,308 methods which will prevent widespread market acceptance of the CA 2,285,308 methods.

A key distinguishing limitation of CA 2,285,308 is that its D-L isomer can not fully protect the Chelated ion thereby allowing for the Chelated ion to participate in insoluble complexes such as carbonates, hydroxides, phosphates and the like. These type deficiencies of the teachings of CA 2,285,308 were discussed on page 7, line 10 to page 8, line 21 of Applicant's specification.

Prior art systems involving succinic acids, when used for chelation, have failed to achieve their assumed bonding potential, rendering prior art compounds less attractive as chelating agents in the fertilizer market place. A reference by T.N. Polynova, L.A. Zassourskaya and M.A. Porai-Koshits, entitled, "Crystal Structures of d-Transition Metal Complexes with Iminodisuccinic Acid," published by the Chemical Department, Moscow State University, Moscow, 119899, Russia discusses the problem.

This Polynova et al. reference teaches that:

"in complexation with d-transition metals, the ligand - iminodisuccinic acid (H4ids) does not realize all its coordination possibilities in any of the complexes studied by X-ray analysis. Potentially, the H4ids ligand is pentadentate, but in compounds [Co(H2O)6][Coids(en)]2 · 4H2O (I) and [ZnH2ids(H2O)2] (II) ids4- and H2ids2- ligands are tetradentate regardless of the differences in aprotonization, stoichiometric composition and valent state of complexing atoms. The coordination of Co(III) and Zn(II) in the form of a distorted octahedron is made up of the N-atom and three O- atoms of the H4ids ligand as well as of two N-atoms of the en ligand or two water molecules in I and II respectively. Hence, the three metallocycles are formed as one

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[[beta]] -carboxyl branch [which] remains uncoordinated by the metal (aprotonized in I and protonized in II). In I an intramolecular H-bond is formed between the free [[beta]] -carboxyl and the amino group of ethylene-diamine. In II the intramolecular H-bond is not formed: H-atoms (one of them connected with N, another, with the O-atom of the uncoordinated [[beta]]-carboxyl group) form intermolecular H-bonds".

Thus, the prior art teaches that while the Iminodisuccinates have value, they fail to provide adequate chelation of metal ions, particularly for uses such as in phosphate fertilizer solutions. Such failure stems from several qualities of the compound. The most efficacious of chelation compounds have at least six nonbonded electron pairs; and most mineral ions share a coordination number of six. Because some isomers of Iminodisuccinate are tetradente, the complexes are vulnerable to carbonate, hydroxide, and, phosphate participation in the complex and such complexes are insoluble. Further, iminodisuccinic isomers have the ability to donate four electron pairs, and with the prior art methods of synthesis, there are a number of isomers that can not provide five pairs because of bond strain or bond angle limitations. Iminodisuccinate is mostly found as a tetradente-chelating agent. Being tetra dente prevents the compound from being suitable as a commercial chelating agent for use in agriculture and industry, and particularly for example, in phosphorus fertilizers.

On pages 16 and 17 of his specification, Applicant states (emphasis added):

In the first step, the primary or secondary amide reaction will occur to yield essentially 100% of the desired product. Then the heat from the amide reaction fuels the radical reaction, in the same vessel at the same time. Me(OH), NH₃, or polyfunctional amine and water further react producing poly functional amine substituted amino disuccinic acid or salt. **All processes occur without the heating commonly needed in prior art methods for condensing, and occur with fewer raw materials and less**

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equipment than prior art methods, thereby offering an economic advantage over those methods.

I have discovered that all isomers with the added Lewis base functionality (or with Lewis base functional groups) from either the acid amide or the additional groups attached to the imido group, have the ability to donate at least five nonbonded pairs without hindrance or bond strain; unlike the non-substituted lminodisuccinates' isomers, the compounds of the present invention may find broad commercial use.

Another unique feature of the compounds of the present invention is that they are water borne and hydrolysis of a polymer will not be necessary. Therefore, with one reaction vessel, at ambient pressure, without the need for heating, the N, N -amino disuccinic amides of the present invention can be prepared.

Without intending to limit the invention, it is presently believed that the effectiveness of the compositions of the present invention for chelation is achieved by adding the amide functionality to a carboxyl group, or by an organic substitution with an additional Lewis base functionality to the imino group, such that either the bond angles are changed or there are additional Lewis bases capable of donating non bonded pairs of electrons, thereby allowing any and all of the isomers to participate in the chelation and coordinate with six sites. A chelation compound suitable for phosphorus fertilizer compositions is thus produced according to the present invention.

The products prepared by the method of CA 2,285,308 are not capable of chelating in the manner of Applicant's products. The products of CA2,285,308 are

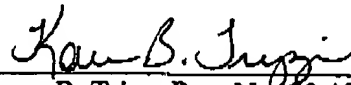
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consequently not suitable for phosphorus fertilizer compositions. Applicant respectfully submits that he has distinguished the prior art.

Applicant respectfully submits that the claims as amended are now in condition for allowance and Applicant respectfully requests the Examiner to allow the application to proceed to issue.

Respectfully submitted,

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Accordingly, there has been a long felt, and unfulfilled need for more efficient, more economical, and more environmentally friendly chelation methods and compositions. These methods and compositions could be used to deliver micronutrient levels of trace metals to plants, to aid in delivery of other horticultural and agricultural chemicals, and, for fertilizers with required metal nutrients necessary for plant growth, development, and disease resistance. The present invention meets such needs.

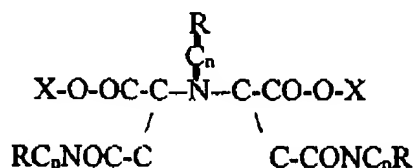
SUMMARY OF THE INVENTION

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Chelating compositions comprising modified iminodisuccinic acid and a simple method of making such acid are disclosed. The modified iminodisuccinic acids of the invention have one or more of the following six formulas:

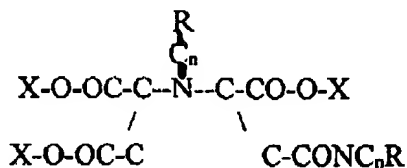
(i)

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20 (ii)

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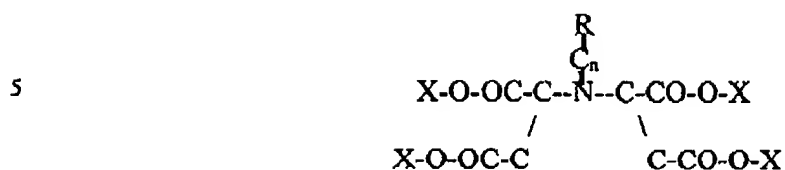
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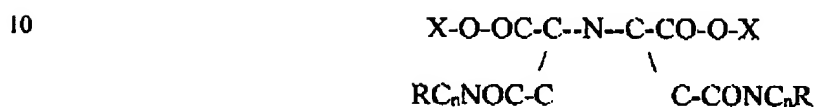
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(iii)

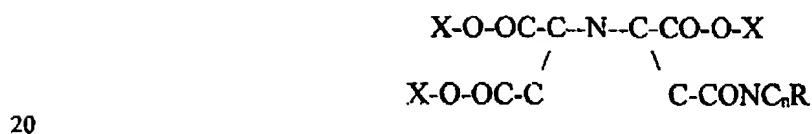


(iv)

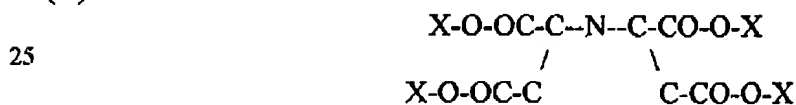


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(v)



(vi)

Where X ^{is} [may be] H,

30 transition metal;

Where n ^{is} [may be] 1 to 10; andWhere R ^{is} [may be] a Lewis base capable of donating a nonbonded pair of electrons.

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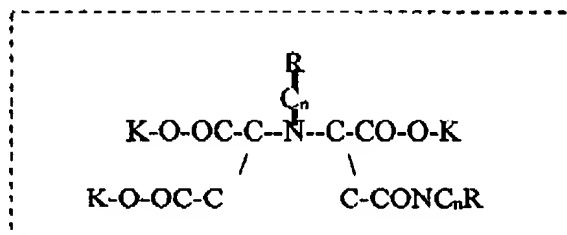
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EXAMPLE 2

In a preliminary lab synthesis trial 120 grams of monoethanolamine was added to an Erlenmeyer flask submerged in an ice water bath. Then, 28 grams of potassium hydroxide flake was added. Later 49 grams of maleic anhydride was added to the flask with
 5 mechanical stirring. The reaction occurred producing an ethanolmaleic amide. The mix was viscous and yellow in color. Upon cooling 49 grams of maleic anhydride was added. Another 28 grams of potassium hydroxide flake was added and 40 ml of water was then blended in. The blend was then allowed to deliquesce over night producing a clear yellow liquid. Compounds were produced having the following formula:



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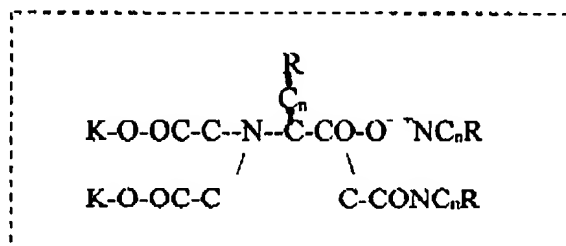
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EXAMPLE 15

In a preliminary lab synthesis trial, 61 grams of monoethanolamine were added to an Erlenmeyer flask submerged in an ice water bath. Then 49 grams of maleic anhydride were added to the flask with mechanical stirring. The mix was viscous and red in color. The reaction took place and the ethanolamine salt of N-ethanolmaleicamide was produced. The flask was hot to touch. While the blend was still warm, and while stirring, 54 grams of a 50% solution of potassium hydroxide were added to the blend. The blend was then allowed to deliquesce over night. Compounds of the present invention having the following formula resulted, where R is a hydroxyl, and n is 2:



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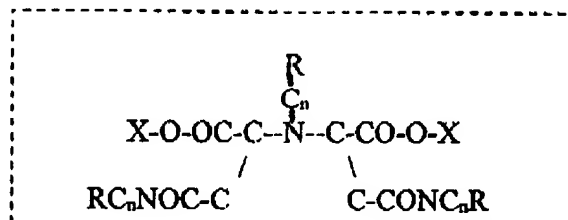
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EXAMPLE 16

A five percent chelated iron solution was prepared by blending 18 ml of water with 100 grams of a (10% Fe) ferric nitrate solution. Once in solution, 82 grams of the compound produced in Example 10 was added. The finished solution was dark red, had a pH of 5, and was clear and free of precipitates. This chelated iron solution is suitable for blending with phosphorus fertilizers.

EXAMPLE 17

In a preliminary lab synthesis trial, 45 grams of monoethanolamine were added to an Erlenmeyer flask with 28 grams of potassium hydroxide. Then 49 grams of maleic anhydride were added to the flask with mechanical stirring. The reaction occurred producing heat; the mix was viscous and red in color. Once the blend cooled, 200 ml of water were added and a light orange-red solution of diethanolsuccinamicamide-amino ethanol was produced, having the following formula, where X is potassium, R is a hydroxyl, and n is 2.



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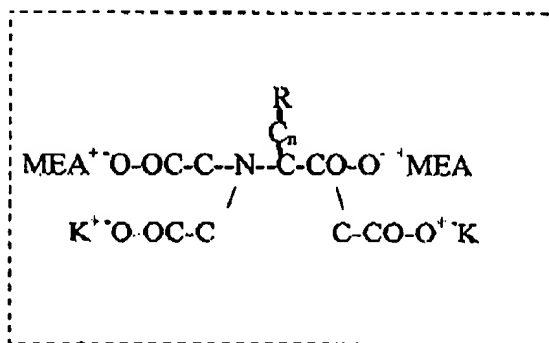
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EXAMPLE 25

In a preliminary lab synthesis trial, 45 grams of monoethanolamine were added to an Erlenmeyer flask with 28 grams of potassium hydroxide and 10 ml of water. The flask was then placed in an ice bath. Then 49 grams of maleic anhydride were added to the flask with mechanical stirring. A reaction occurred producing heat resulting in a compound that was viscous and orange-red in color. This compound has the following formula, where R is a hydroxyl and n is 4:

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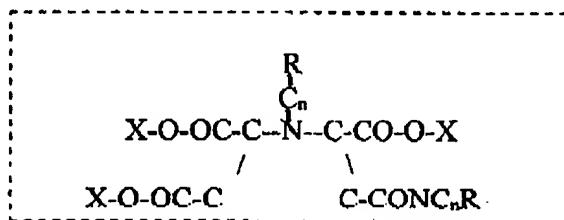
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EXAMPLE 34

A nine percent chelated zinc solution was prepared by blending 50 ml of water with 22.4 grams zinc oxide. Concentrated HCl was added until the solution was clear. Once in solution, 125 grams of the compound produced in Example 10 was added. The finished
 5 solution was red, had a pH of 5, and was clear and free of precipitates. This chelated zinc solution is suitable for blending with phosphorus fertilizers 2-ethanolaminesuccinic- N-ethanolsuccinicanide (tri potassium salt) has the following formula:



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EXAMPLE 35

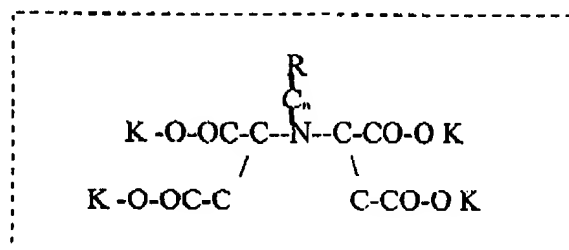
SYNTHESIS of N,N - DISUCCINICAMINOETHANOL (tetra potassium salt)

2 maleic anhydride(s) + 4 KOH (aq) + 1 monoethanolamine (l) _

5 N,N DISUCCINICAMINOETHANOL (tetra potassium salt)(s)

	Grams per mole	Grams needed for 1 mole of N,N- DISUCCINICAMINOETHANOL (tetra potassium salt)	Grams needed for 0.25 Mol
MALEIC ANHYDRIDE	98.06	196.12	49
MONOETHANOLAM INE	61.0	61	16
POTASSIUM HYDROXIDE	56	224	56
WATER	18	36	9
			130

Potassium hydroxide was weighed out and added to the water. The monoethanolamine was then added to the blend and stirred in. Maleic anhydride was then added slowly and
10 allowed to react to form N,N - disuccinic-amino-ethanol tetra potassium salt. The finished product was a light orange-red solid. The mixture was allowed to stand over night and 200 ml of water was then added to produce an orange-red clear 0.75 M solution of N, N-disuccinic-amino-ethanol tetra potassium salt, having the formula below, where R is a hydroxyl group and n is 2.

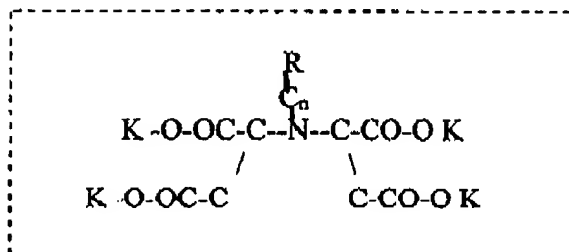


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EXAMPLE 42

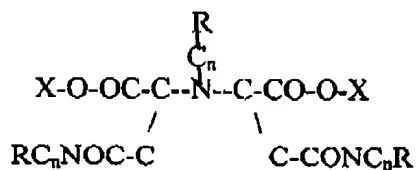
One hundred ml of the solution prepared in Example 41 was added to 500 ml of water and blended. 10 ml of 1.8-M ferric nitrate was then added to the mixture. Once a clear solution was formed at a pH of 10, ten grams of potassium phosphate were added to the solution to produce an orange-red clear solution without precipitates. The potassium salt of maleic acid was tested as a chelating agent.

In a separate flask 20 grams of maleic anhydride were blended in 500 ml of water. Potassium hydroxide was then added to the blend to raise the pH to 10. Later ten ml of 1.8M ferric nitrate was added to the mix and 10 grams of potassium phosphate was also blended in. When the mechanical blending stopped, a rust colored solid precipitated to form a layer at the bottom of the flask with a clear colorless layer above. The contents of the flask were then blended again while MFA was added to the mix. The precipitate never went back into solution. This work shows the compounds used for the synthesis of a substituted iminodisuccinate can not be used separately to achieve the results of the present invention.

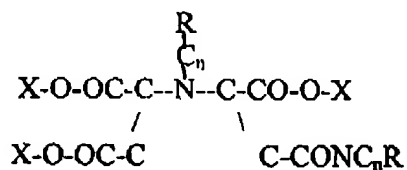
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1. (Amended) A chelating composition comprising a modified iminodisuccinic acid, or a salt thereof, having one or more of the following formulas:

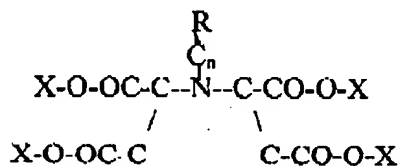
(a)



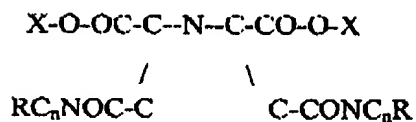
(b)



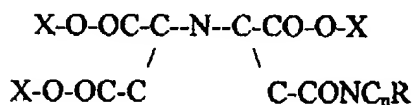
(c)



(d)



(e)



where X [may be] is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal;

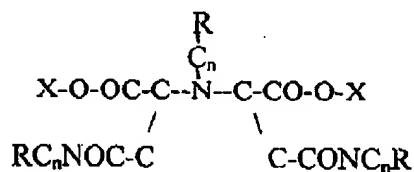
where n [may be] is 1 to 10; and

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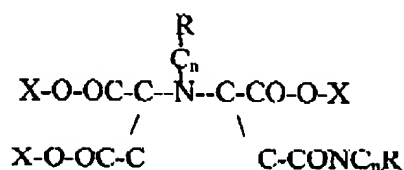
where R [may be] is a Lewis base capable of donating a nonbonded pair of electrons.

7. (Amended) The method of claim 6 wherein said modified iminodisuccinic acid has one of the following formulas:

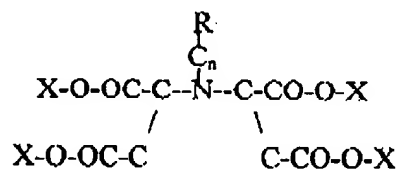
(a)



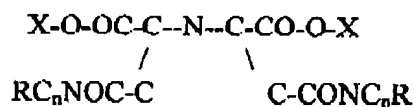
(b)



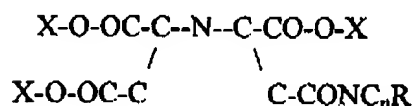
(c)



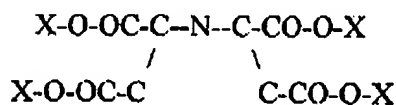
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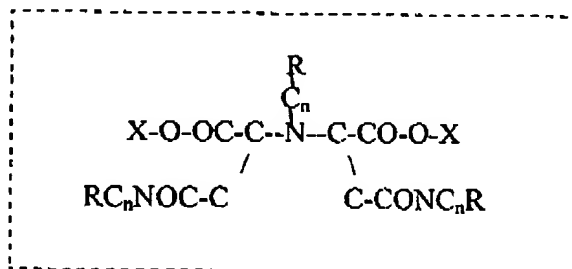
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where X [may be] is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal;

where n [may be] is 1 to 10; and

where R [may be] is a Lewis base capable of donating a nonbonded pair of electrons.

11. (Amended) The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula;

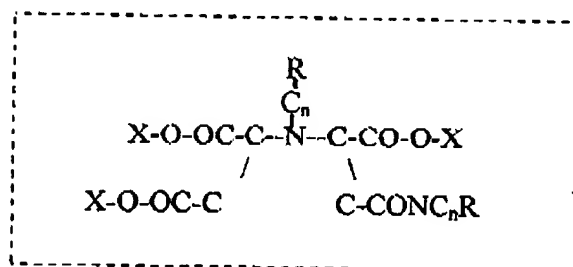


where X [may be] is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal; n [may be] is 1 to 10, and R [may be] is a Lewis base capable of donating a nonbonded pair of electrons, wherein said synthesis comprises the steps of:

- (a) adding an acid anhydride or lactone to a first polyfunctional amine, and allowing same to react to form a N-polyfunctional acid common name amide; and
- (b) adding water, Me(OH), and a second polyfunctional amine to said N- polyfunctional acid common name amide and allowing same to react to form an imino di N- polyfunctional acid common name amide.

15. (Amended) The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula:

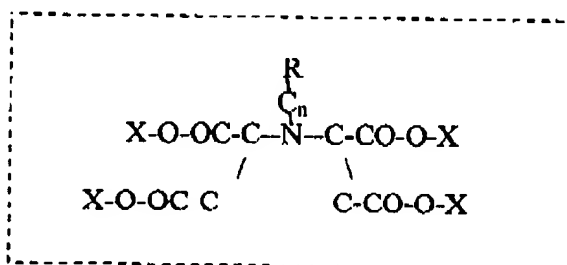
MARKED UP VERSION TO SHOW CHANGES



where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal salts, n is 1 to 10, R is a [I]Lewis base capable of donating a nonbonded pair of electrons, and Me is selected from the alkali metals, wherein said synthesis comprises the steps of:

- (a) adding an acid anhydride or lactone to a first polyfunctional amine, and allowing same to react to form a N- polyfunctional acid common name amide; and
- (b) adding to said N- polyfunctional acid common name amide, water, a second polyfunctional amine, an acid anhydride or lactone, a Me (OH), and allowing same to react to form said compounds.

19. (Amended) The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula:



where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal salts; where n is 1 to 10; where R is a Lewis base capable of donating a nonbonded pair of electrons, wherein said synthesis comprises the steps of:

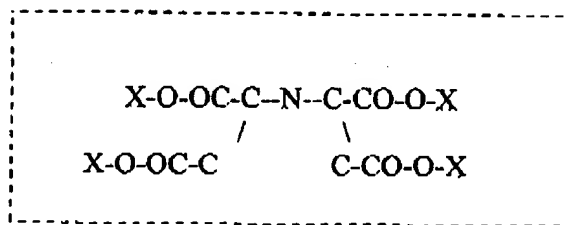
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adding maleic anhydride or malic acid to Me (OH) + polyfunctional amine + water, and allowing same to react to form the N, N-disuccinicamino(:functional group).

where X may be H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal; where n may be 1 to 10; where R may be a lewis base capable of donating a nonbonded pair of electrons; wherein said synthesis comprises the steps of:

- (a) adding an acid anhydride or lactone to a first polyfunctional amine and allowing same to react to form an N- polyfunctional acid common name amide;
- (b) adding to said N- polyfunctional acid common name amide, water, ammonia + maleic anhydride or maleic acid (salt) and allowing same to react to form said compounds.

31. (Deleted) [The use of iminodisuccinic acid having the following formula



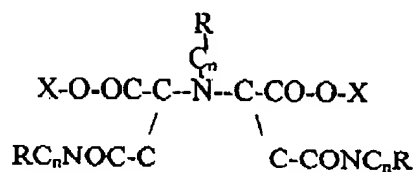
where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal salt.]

33. (Deleted) [The iminodisuccinic acid of claim 31 used as a chelating agent in concentrations of $1/10^a$ to 1part, where a is less then 10, or 1.0×10^{-9} Molar to 3Molar 32.]

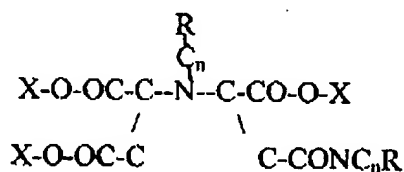
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1. (Amended) A chelating composition comprising a modified iminodisuccinic acid, or a salt thereof, having one or more of the following formulas:

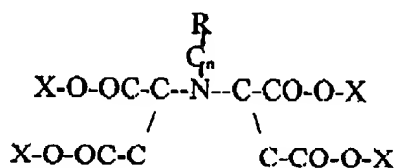
(a)



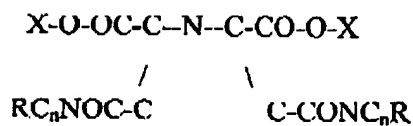
(b)



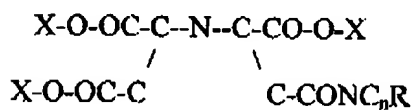
(c)



(d)



(e)



where X [may be] is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal;

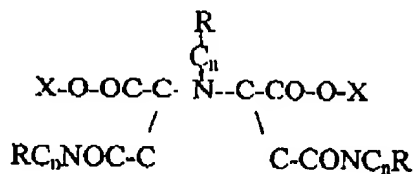
where n [may be] is 1 to 10; and

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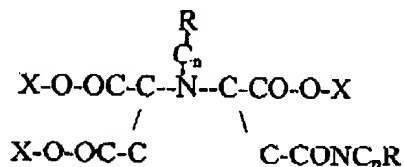
where R [may be] is a Lewis base capable of donating a nonbonded pair of electrons.

7. (Amended) The method of claim 6 wherein said modified iminodisuccinic acid has one of the following formulas:

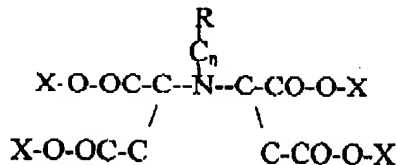
(a)



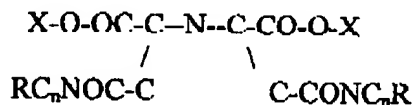
(b)



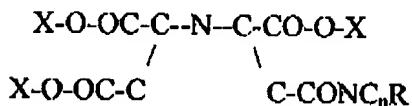
(c)



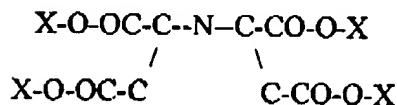
(d)



(e)



(f)



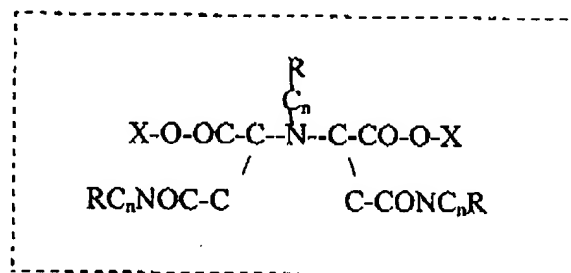
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where X [may be] is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal;

where n [may be] is 1 to 10; and

where R [may be] is a Lewis base capable of donating a nonbonded pair of electrons.

11. (Amended) The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula;

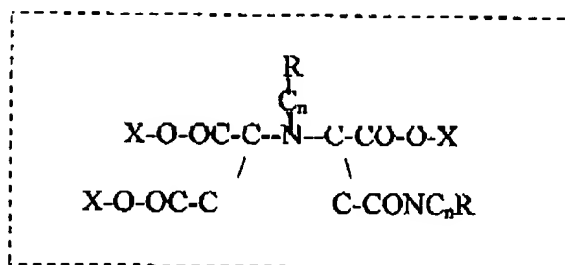


where X [may be] is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal; n [may be] is 1 to 10, and R [may be] is a Lewis base capable of donating a nonbonded pair of electrons, wherein said synthesis comprises the steps of:

- (a) adding an acid anhydride or lactone to a first polyfunctional amine, and allowing same to react to form a N-polyfunctional acid common name amide; and
- (b) adding water, Me(OH), and a second polyfunctional amine to said N- polyfunctional acid common name amide and allowing same to react to form an imino di N- polyfunctional acid common name amide.

15. (Amended) The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula:

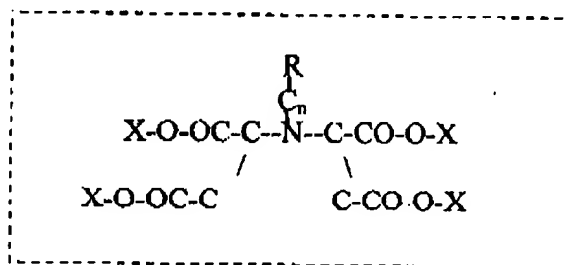
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where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal salts, n is 1 to 10, R is a lewis base capable of donating a nonbonded pair of electrons, and Me is selected from the alkali metals, wherein said synthesis comprises the steps of:

- (a) adding an acid anhydride or lactone to a first polyfunctional amine, and allowing same to react to form a N- polyfunctional acid common name amide; and
- (b) adding to said N- polyfunctional acid common name amide, water, a second polyfunctional amine, an acid anhydride or lactone, a Me (OH), and allowing same to react to form said compounds.

19. (Amended) The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula:



where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal salts, where n is 1 to 10; where R is a Lewis base capable of donating a nonbonded pair of electrons, wherein said synthesis comprises the steps of:

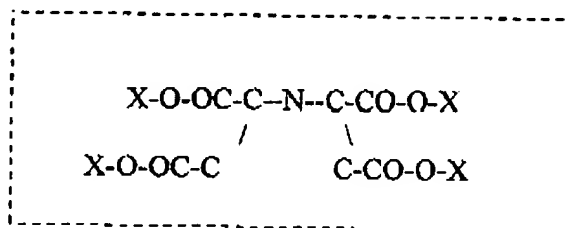
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adding maleic anhydride or malic acid to $\text{Me}(\text{OH}) + \text{polyfunctional amine} + \text{water}$, and allowing same to react to form the N, N-disuccinamicamino(:functional group).

where X may be H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal; where n may be 1 to 10; where R may be a lewis base capable of donating a nonbonded pair of electrons; wherein said synthesis comprises the steps of:

- (a) adding an acid anhydride or lactone to a first polyfunctional amine and allowing same to react to form an N- polyfunctional acid common name amide;
- (b) adding to said N- polyfunctional acid common name amide, water, ammonia + maleic anhydride or maleic acid (salt) and allowing same to react to form said compounds.

31. (Deleted) [The use of iminodisuccinic acid having the following formula



where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal salt.]

33. (Deleted) [The iminodisuccinic acid of claim 31 used as a chelating agent in concentrations of $1/10^a$ to 1part, where a is less then 10, or 1.0×10^{-9} Molar to 3Molar 32.]